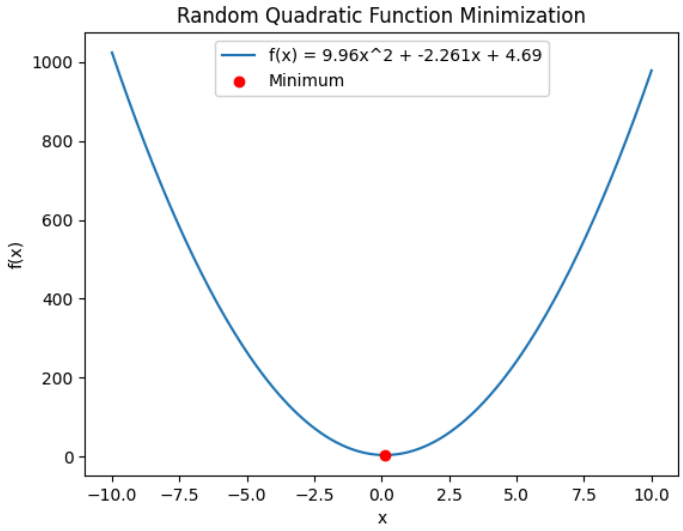
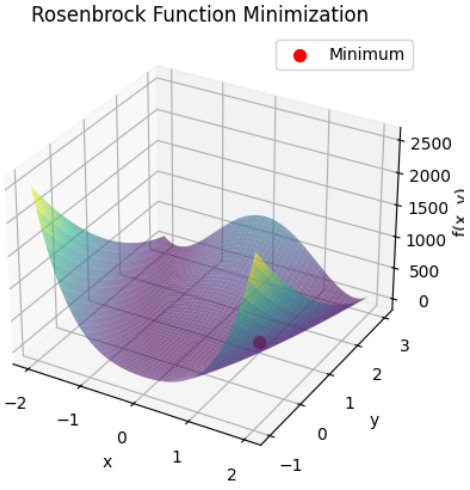
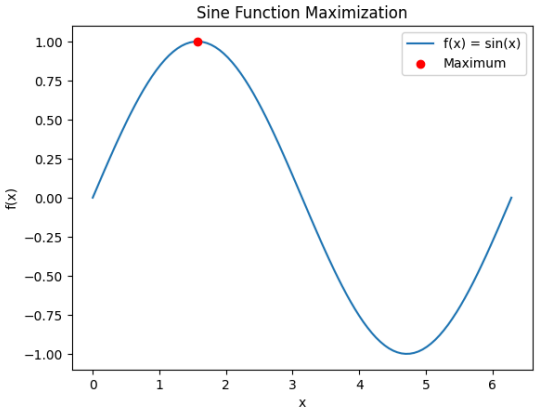
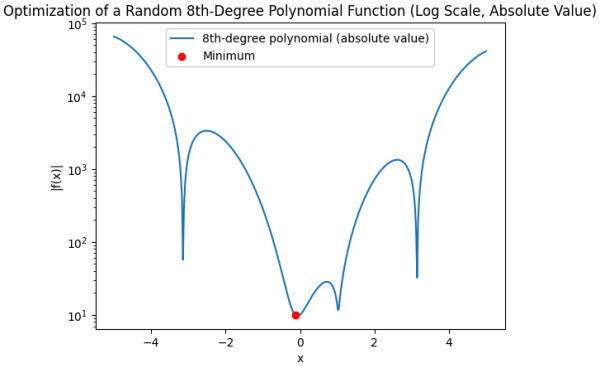
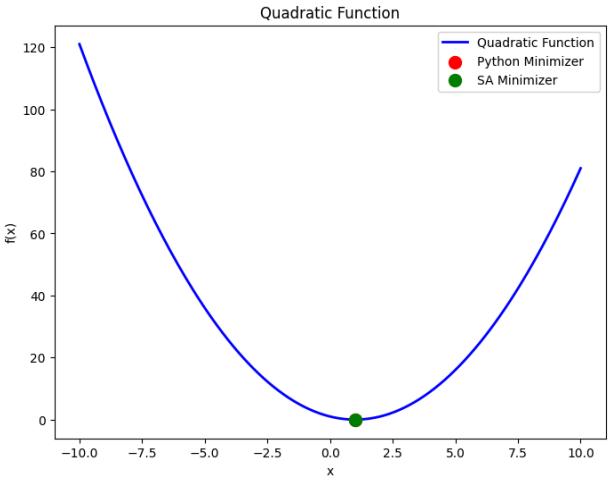
Exercise 1:

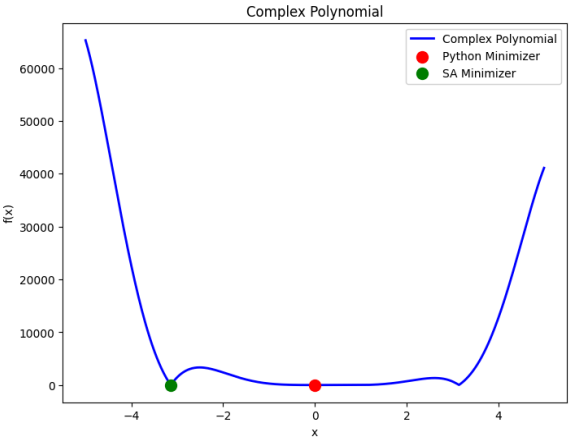

Random Quadratic Function Minimization
f(x) = 9.96x^2 + -2.261x + 4.69
Minimum
f(x)
x

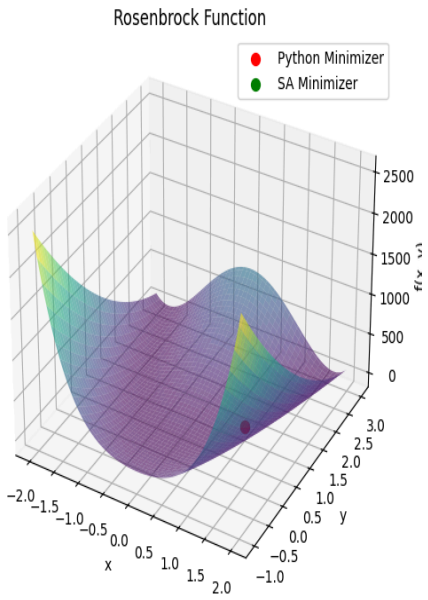

Rosenbrock Function Minimization
Minimum
x
y

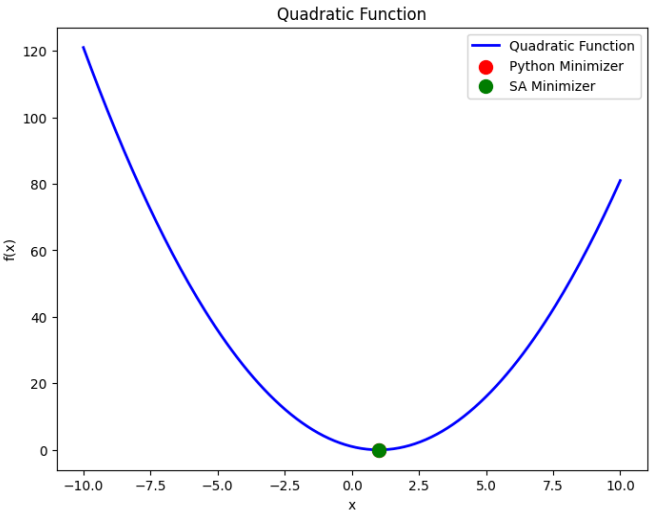

Sine Function Maximization
f(x) = sin(x)
Maximum
f(x)
x


Optimization of a Random 8th-Degree Polynomial Function (Log Scale, Absolute Value)
8th-degree polynomial (absolute value)
Minimum
|f(x)|
x


Quadratic Function
Quadratic Function
Python Minimizer
SA Minimizer
f(x)
x


Complex Polynomial
Complex Polynomial
Python Minimizer
SA Minimizer
f(x)
x



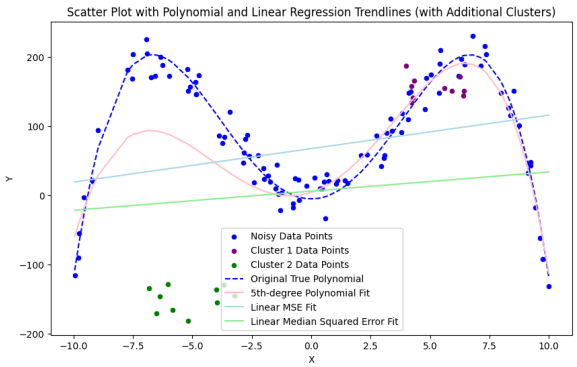


	Function	Python Minimizer x	Python Minimizer f(x)	SA x	SA f(x)
0	Quadratic	1.0	0.0	[1.0004954894843328]	0.00000
1	Rosenbrock	[0.9999969961427417, 0.9999939817462934]	0.0	[1.002650739556813, 1.0056600933958983]	0.00002
2	Sine	1.570796	-1.0	[2.257672857889635]	-0.77323
3	Polynomial	0.0	10.0	[-3.1416215206276163]	10.35808

+ Code + Markdown

Exercise 2:

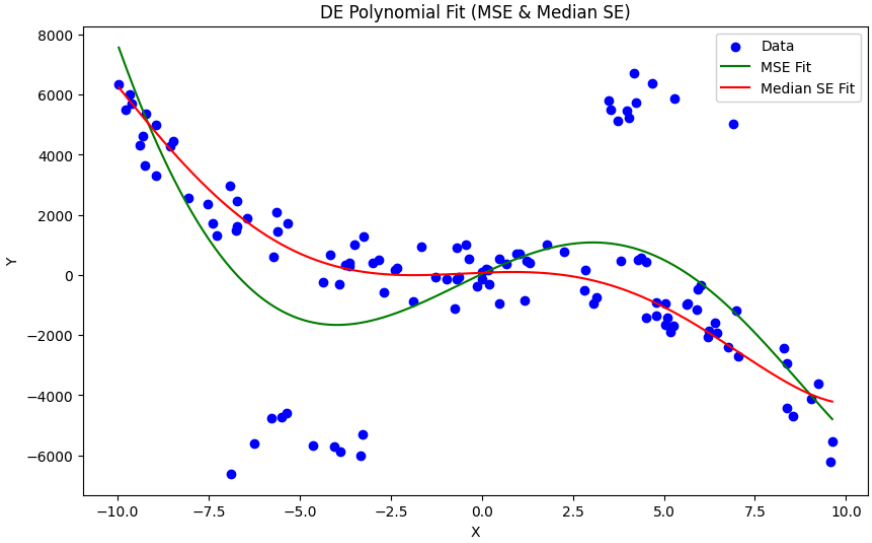
Fitted 5th-degree polynomial:
f(x) = -0.001 * x^5 + -0.073 * x^4 + -0.054 * x^3 + 6.323 * x^2 + 11.315 * x^1 + 4.291 * x^0
Mean Squared Error (MSE) of fitted polynomial: 6028.19710663822
Median Squared Error (MedSE) of fitted polynomial: 651.0021373433062



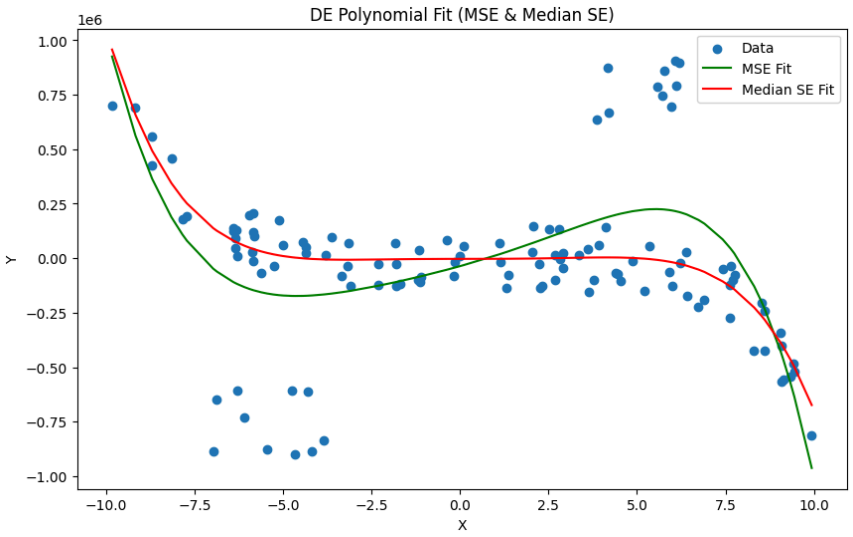
Original random 5th-degree polynomial coefficients:
[-5.195 0.   9.359 0.   -0.105 0.]
Polynomial function: f(x) = -0.105*x^4 + 9.359*x^2 + -5.195*x^0
Fitted 5th-degree polynomial coefficients:
['-0.001', '-0.073', '-0.054', '6.323', '11.315', '4.291']

Linear MSE Regression coefficients (slope and intercept):
Slope: 4.8461721023868956
Intercept: 67.58832344536287

Linear Median Squared Error Regression coefficients (slope and intercept):
Slope: 2.7754547006261947
Intercept: 6.126588525023602



Original random 5th-degree polynomial coefficients:
[-9.549 7.43   0.   -6.051 0.   0.]
Polynomial function: f(x) = -6.051*x^3 + 7.43*x^1 + -9.549*x^0
Fitted 5th-degree polynomial coefficients:
['0.090', '0.353', '-22.258', '-35.322', '725.409', '399.436']



MSE: 91049535722.48639, MedSE: 27394877260.80652
Polynomial Fit Coefficients: [-1.29918497e+01 -2.47663175e+01 -2.15711978e+02
3.12439788e+03
 5.24790059e+04 -5.11256412e+04]
DE - MSE Fit : [-3.63318758e+04 4.53383569e+04 3.04265650e+03 1.53140108e+02
 -2.55407451e+01 -1.62813050e+01]
DE - Median SE Fit : [-3111.39466524   170.33557842 -154.86076695   231.16856078
   19.23659949   -11.05354852]

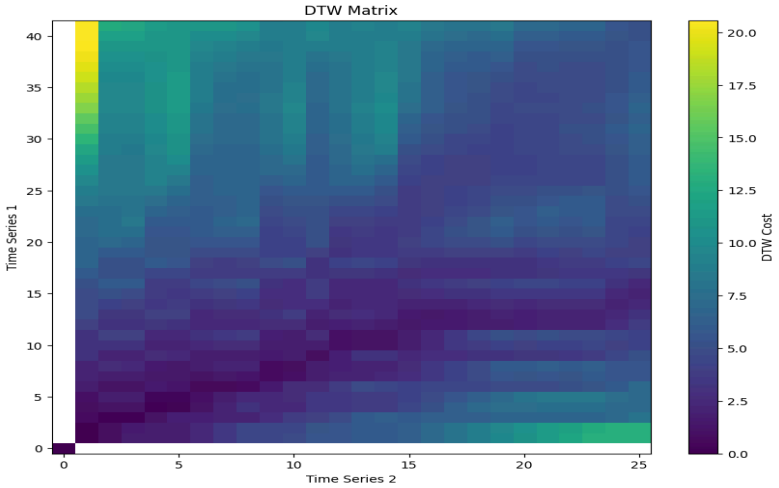
Exercise 3:

[('Acetaminophen', 'Acetaminophen', 0),
 ('Acetaminophen', 'Acetaminpophen', 1),
 ('Acetaminophen', 'Acetanminophen', 1),
 ('Acetaminophen', 'Acetamnophen', 1),
 ('Acetaminophen', 'Acetamfnophen', 1),
 ('Acetaminophen', 'Acetaminopten', 1),
 ('Acetaminophen', 'Amphetamine', 7),
 ('Ibuprofen', 'Ibuprofen', 0),
 ('Ibuprofen', 'Iburofen', 1),
 ('Ibuprofen', 'Ibprofen', 1),
 ('Ibuprofen', 'Ibuprvfen', 1),
 ('Ibuprofen', 'Ibuprofei', 1),
 ('Ibuprofen', 'Ibuprofeg', 1),
 ('Ibuprofen', 'Buspironen', 5),
 ('Aspirin', 'Aspirin', 0),
 ('Aspirin', 'Aspiri', 1),
 ('Aspirin', 'Aspivin', 1),
 ('Aspirin', 'Aspirij', 1),
 ('Aspirin', 'Asvirin', 1),
 ('Aspirin', 'Aapirin', 1),

('Aspirin', 'Mupirocin', 4),
('Amoxicillin', 'Amoxicillin', 0),
('Amoxicillin', 'Amoxqicillin', 1),
('Amoxicillin', 'Amxicillin', 1),
('Amoxicillin', 'Amoxicilln', 1),
('Amoxicillin', 'Amoxicillsn', 1),
('Amoxicillin', 'omoxicillin', 1),
('Amoxicillin', 'Penicillin', 4),
('Metformin', 'Metformin', 0),
('Metformin', 'Metforfmin', 1),
('Metformin', 'Metformiin', 1),
('Metformin', 'Mtformin', 1),
('Metformin', 'Metforcin', 1),
('Metformin', 'Mewformin', 1),
('Metformin', 'Metformin XR', 3)]
Single character changes:
'o' changed to 'p' : 2 times
'p' changed to 'o' : 2 times
'h' changed to 'p' : 2 times
'e' changed to 'h' : 2 times
'n' changed to 'e' : 2 times
'm' changed to 'n' : 1 times
'i' changed to 'm' : 2 times
'n' changed to 'i' : 5 times
'o' changed to 'n' : 1 times
'i' changed to 'n' : 4 times
'n' changed to 'o' : 1 times
'p' changed to 'h' : 1 times
'h' changed to 'e' : 1 times
'e' changed to 'n' : 3 times
'i' changed to 'f' : 1 times
'h' changed to 't' : 1 times
'p' changed to 'r' : 2 times
'r' changed to 'o' : 2 times
'o' changed to 'f' : 2 times
'f' changed to 'e' : 2 times
'u' changed to 'p' : 1 times
'o' changed to 'v' : 1 times
'n' changed to 'g' : 1 times
'r' changed to 'v' : 1 times
'n' changed to 'j' : 1 times
'p' changed to 'v' : 1 times
's' changed to 'a' : 1 times
'i' changed to 'q' : 1 times

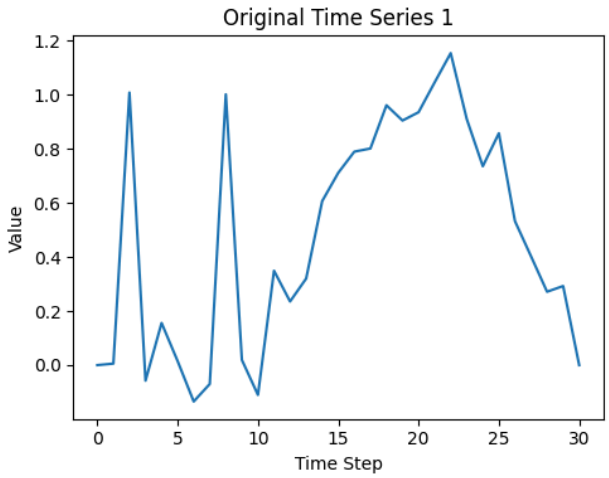
'c' changed to 'i' : 2 times
'i' changed to 'c' : 2 times
'l' changed to 'i' : 2 times
'i' changed to 'l' : 2 times
'o' changed to 'x' : 1 times
'x' changed to 'i' : 1 times
'i' changed to 's' : 1 times
'A' changed to 'o' : 1 times
'm' changed to 'f' : 1 times
'e' changed to 't' : 1 times
't' changed to 'f' : 1 times
'f' changed to 'o' : 1 times
'o' changed to 'r' : 1 times
'r' changed to 'm' : 1 times
'm' changed to 'i' : 1 times
'm' changed to 'c' : 1 times
't' changed to 'w' : 1 times
Transposition detected: Aspirin -> Aspirin
Transposition detected: Aspirin -> Aspirij
Transposition detected: Aspirin -> Asvirin
Transposition detected: Aspirin -> Aapirin
Transposition detected: Amoxicillin -> Amoxicillin
Transposition detected: Amoxicillin -> Amoxicillsn
Transposition detected: Amoxicillin -> omoxicillin
Total transpositions detected: 7

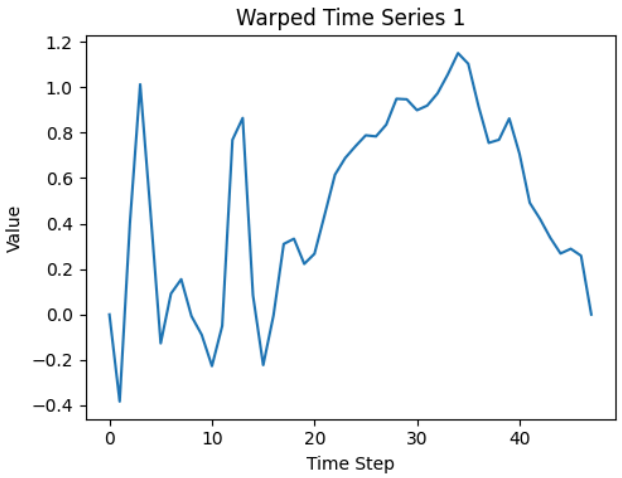
Exercise 4:

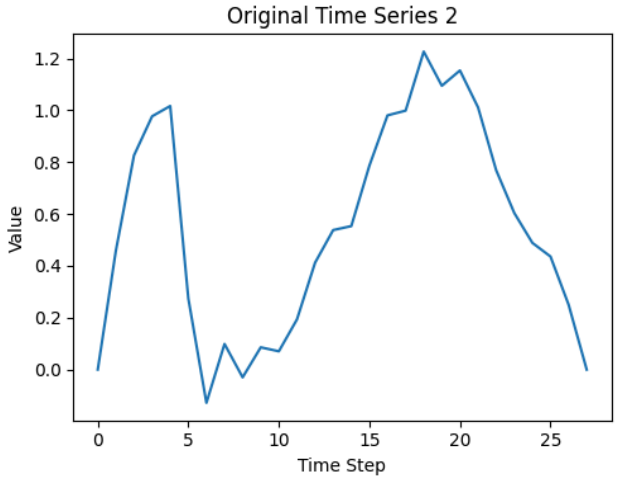


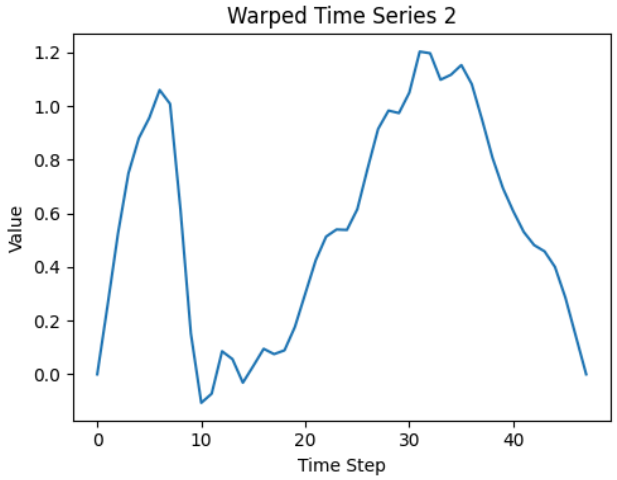
DTW Distance between time series 1 and 2: 5.355226423510705

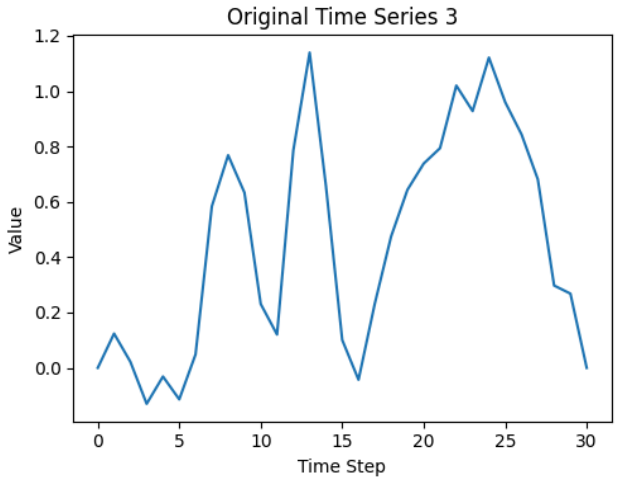
Exercise 5:

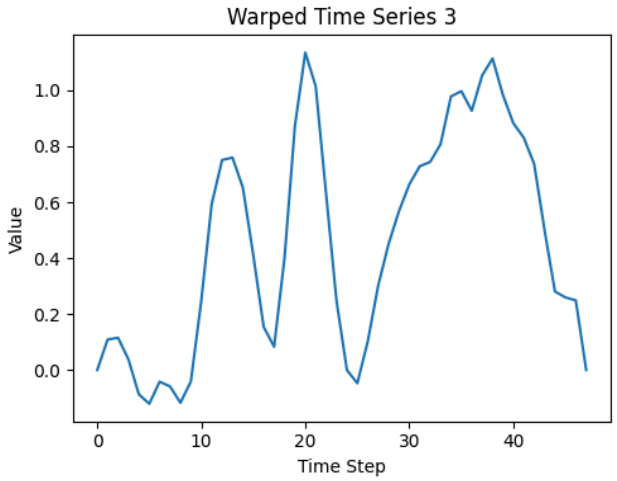

Original Time Series 1
Value
Time Step

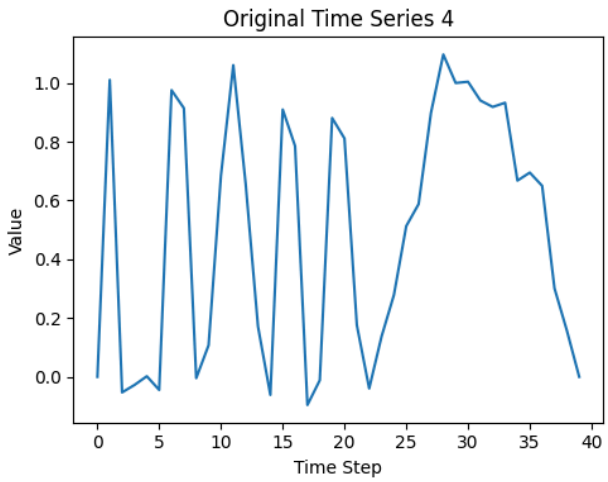

Warped Time Series 1
Value
Time Step

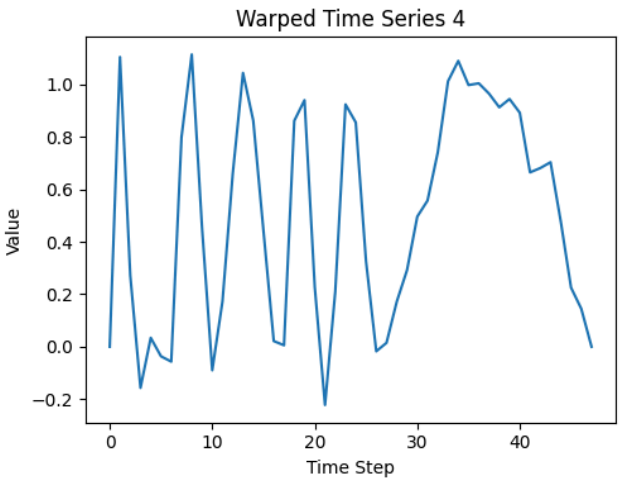

Original Time Series 2
Value
Time Step

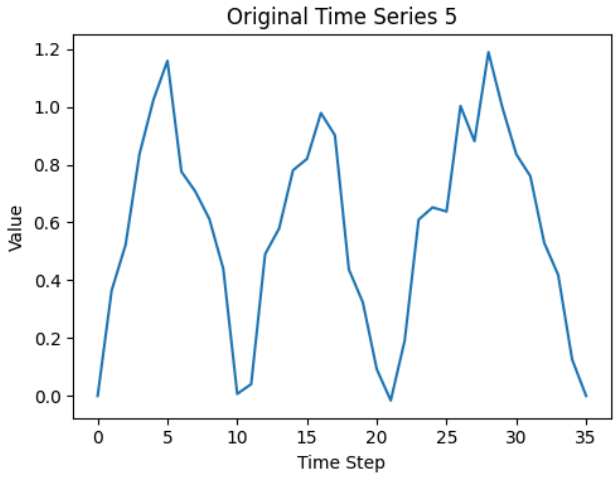

Warped Time Series 2
Value
Time Step

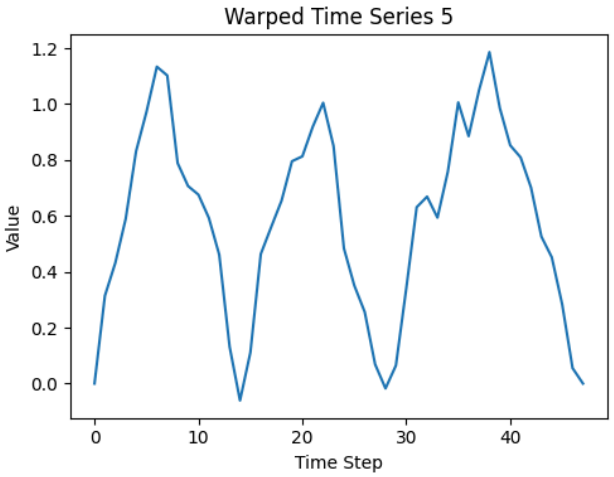

Original Time Series 3
Value
Time Step

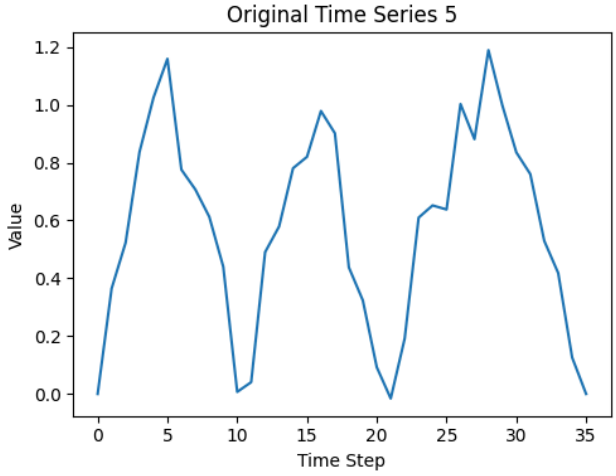

Warped Time Series 3
Value
Time Step

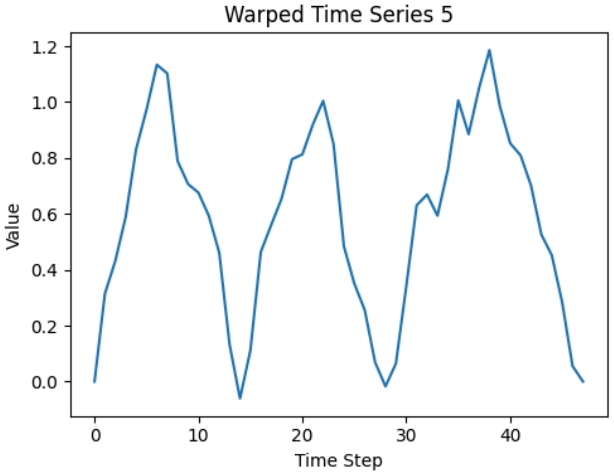

Original Time Series 4
Value
Time Step

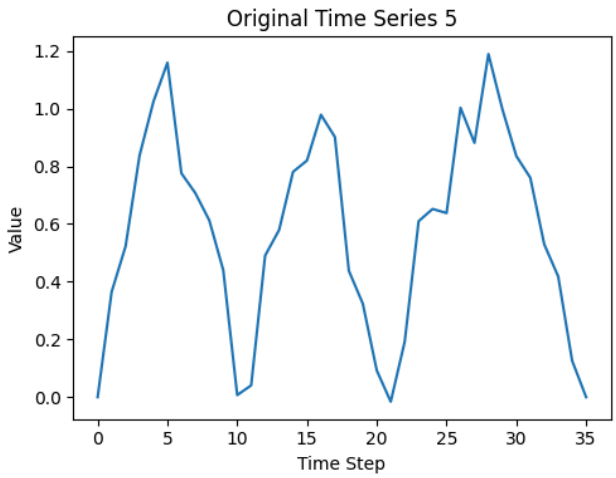

Warped Time Series 4
Value
Time Step

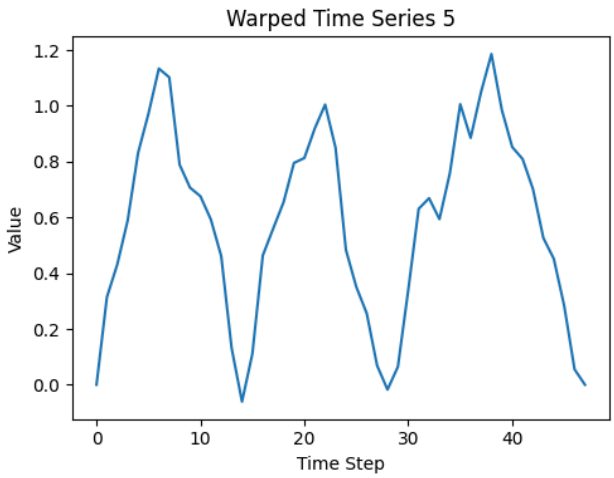

Original Time Series 5
Value
Time Step

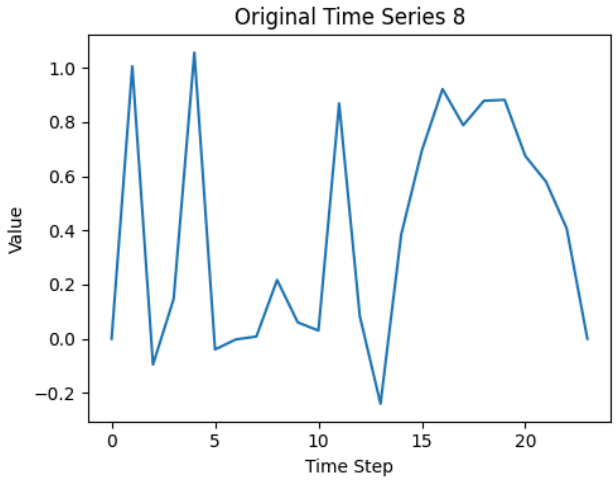

Warped Time Series 5
Value
Time Step

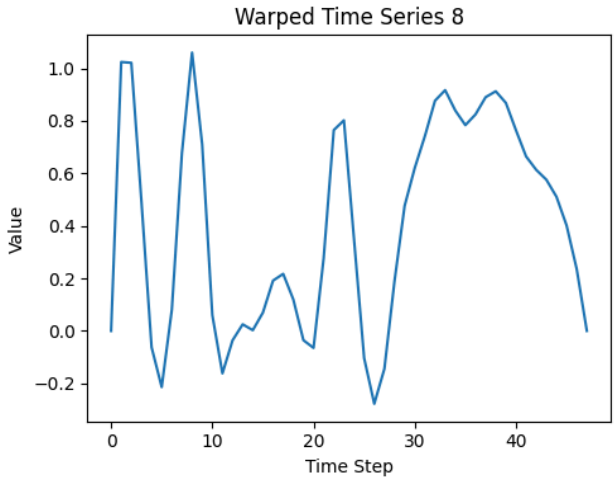

Original Time Series 5
Value
Time Step

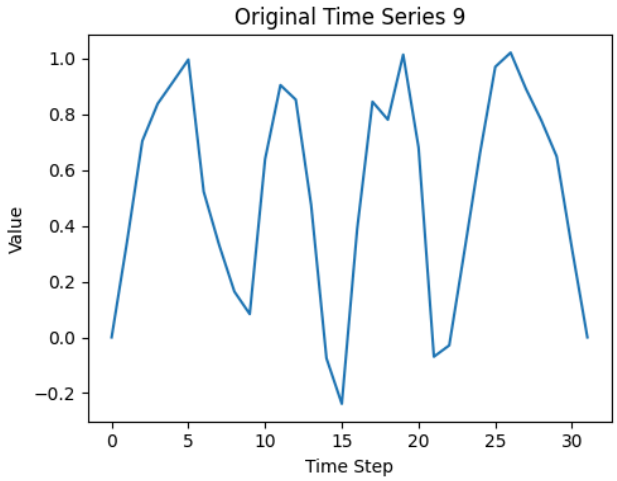

Warped Time Series 5
Value
Time Step

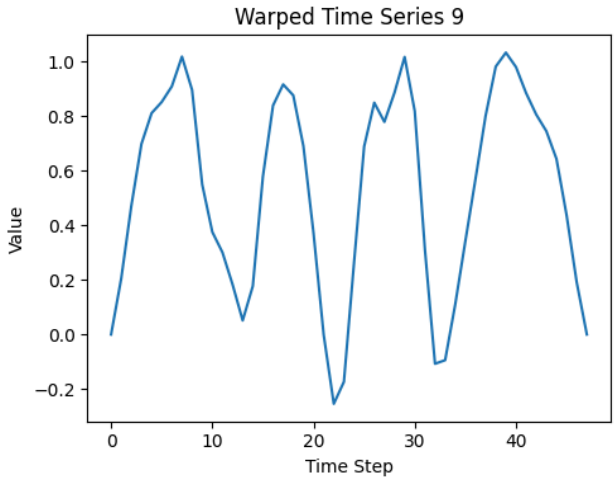

Original Time Series 5
Value
Time Step

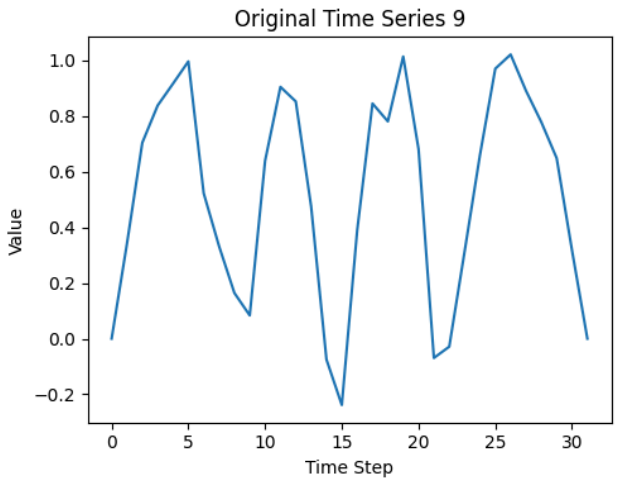

Warped Time Series 5
Value
Time Step

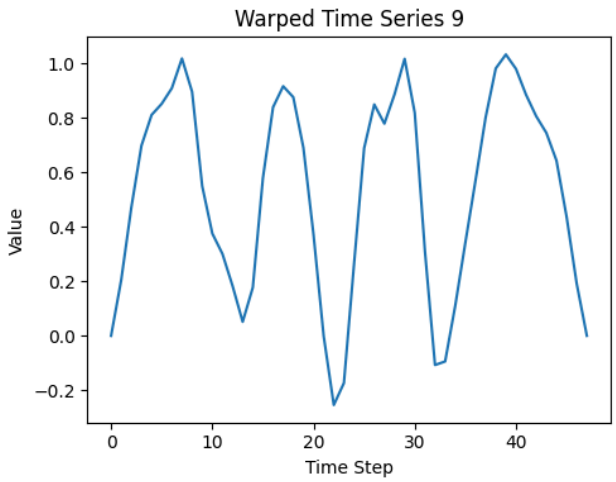

Original Time Series 8
Value
Time Step

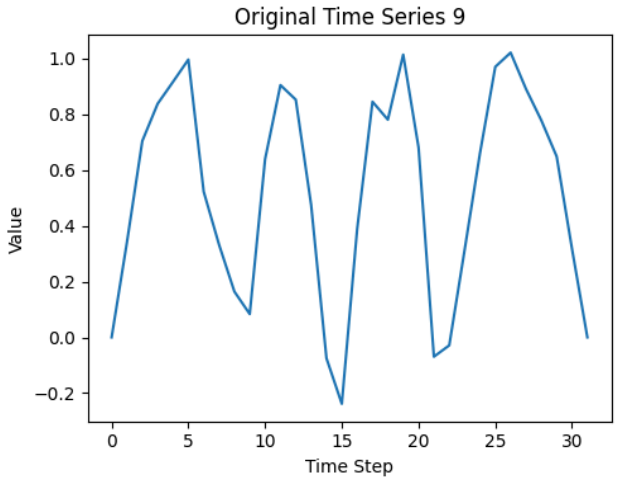

Warped Time Series 8
Value
Time Step

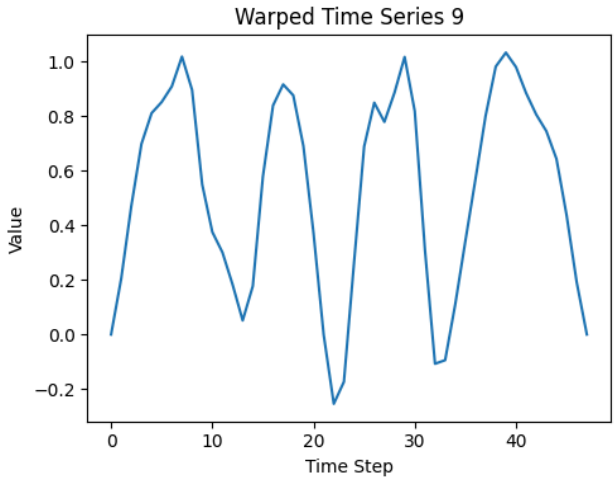

Original Time Series 9
Value
Time Step

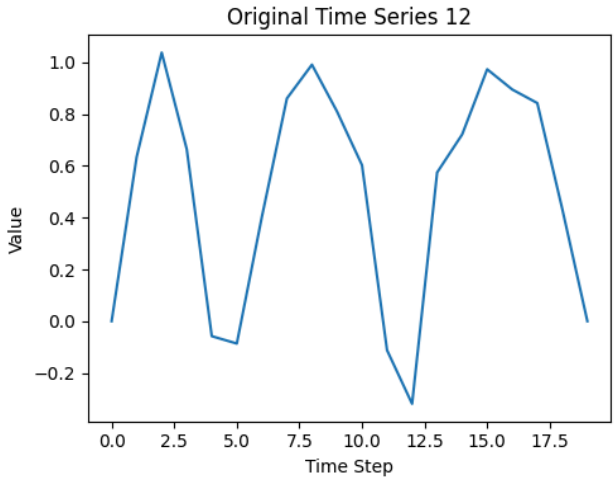

Warped Time Series 9
Value
Time Step

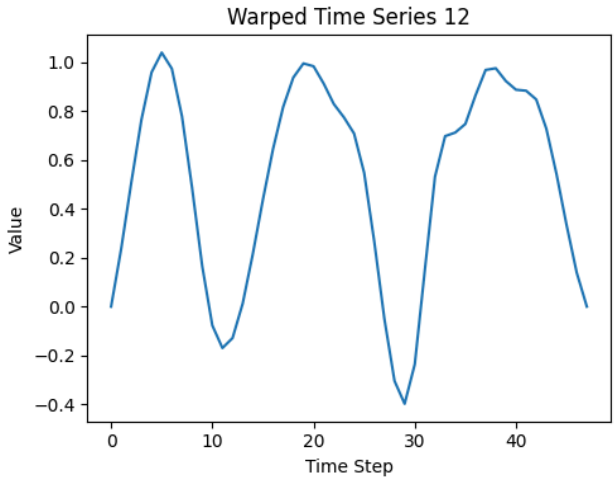

Original Time Series 9
Value
Time Step

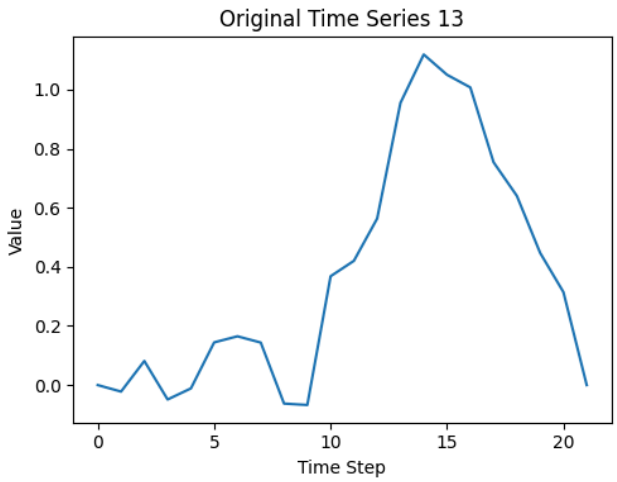

Warped Time Series 9
Value
Time Step

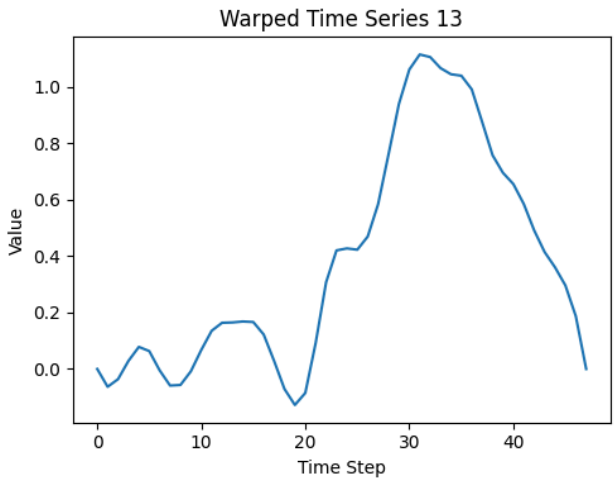

Original Time Series 9
Value
Time Step

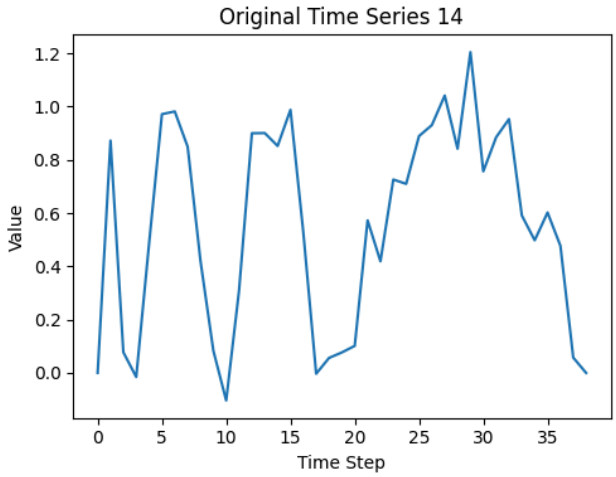

Warped Time Series 9
Value
Time Step

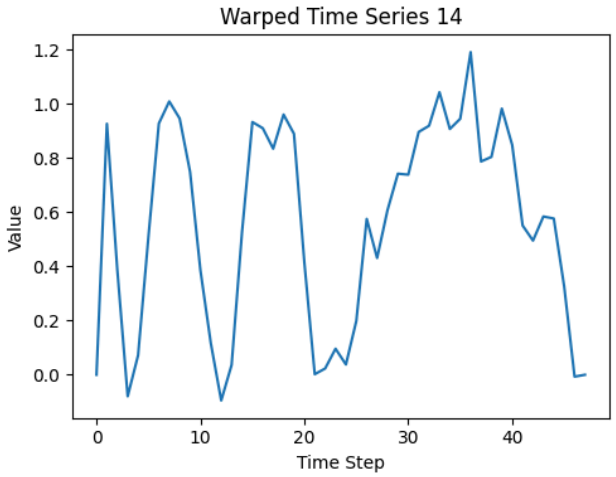

Original Time Series 12
Value
Time Step


Warped Time Series 12
Value
Time Step


Original Time Series 13
Value
Time Step


Warped Time Series 13
Value
Time Step


Original Time Series 14
Value
Time Step


Warped Time Series 14
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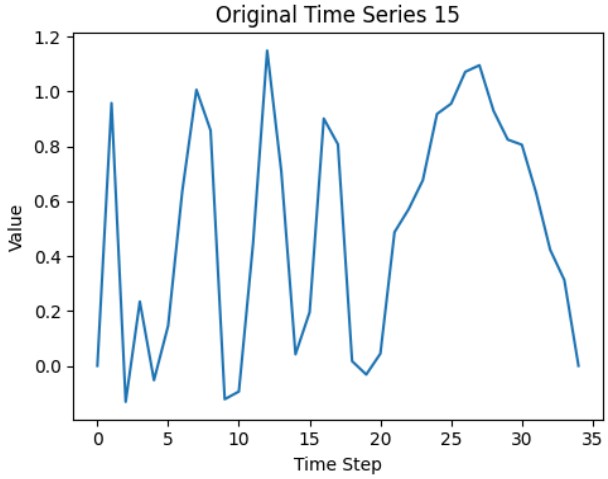
Time Step


Original Time Series 15
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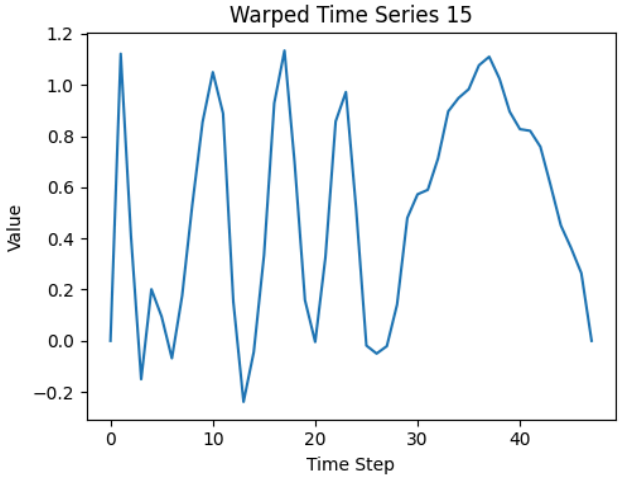
Time Step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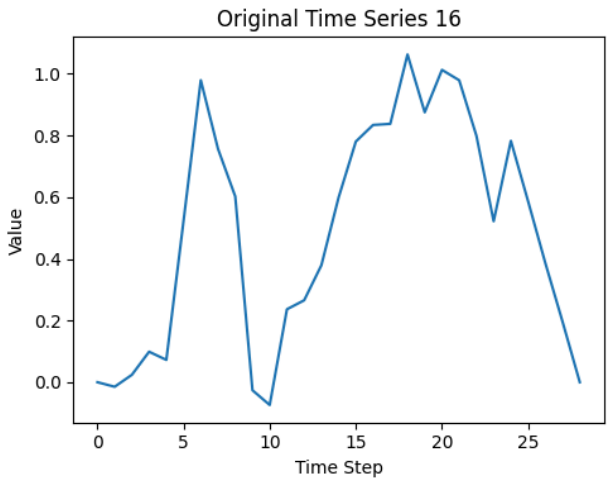
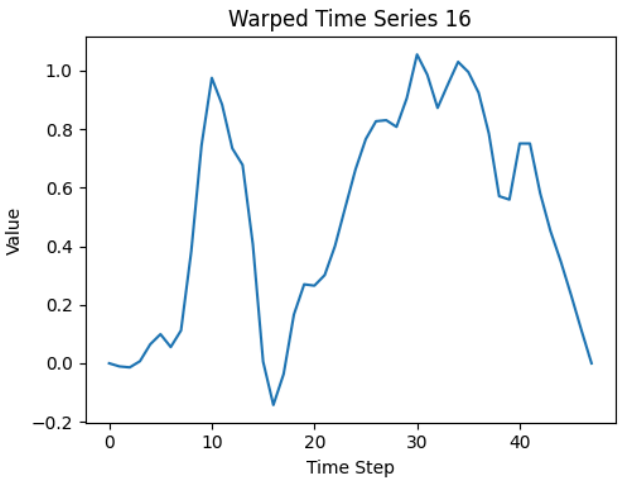
Time Step


Original Time Series 16
Value
Time Step


Warped Time Series 16
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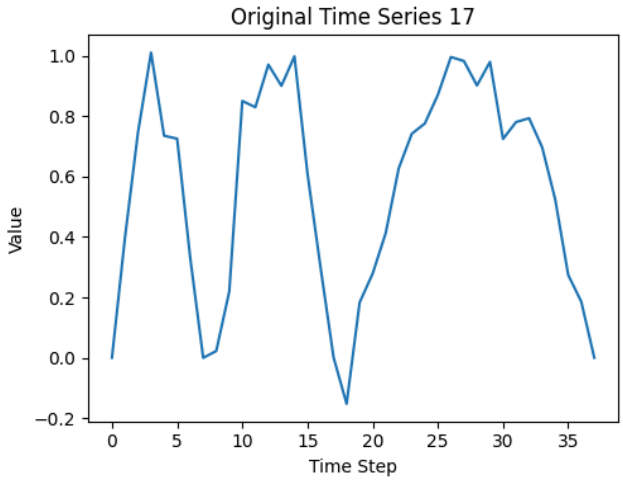
Time Step


Original Time Series 17
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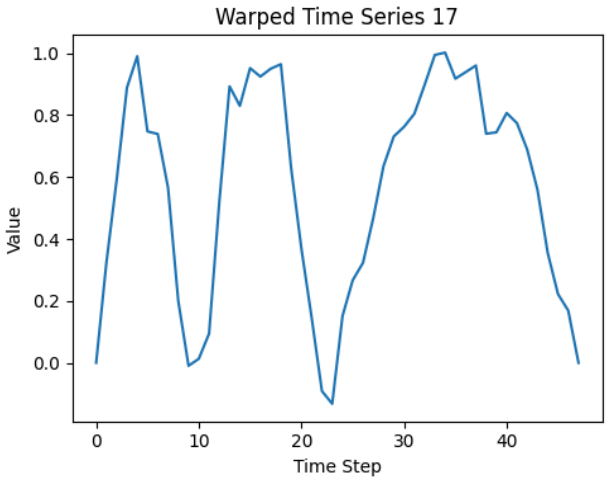
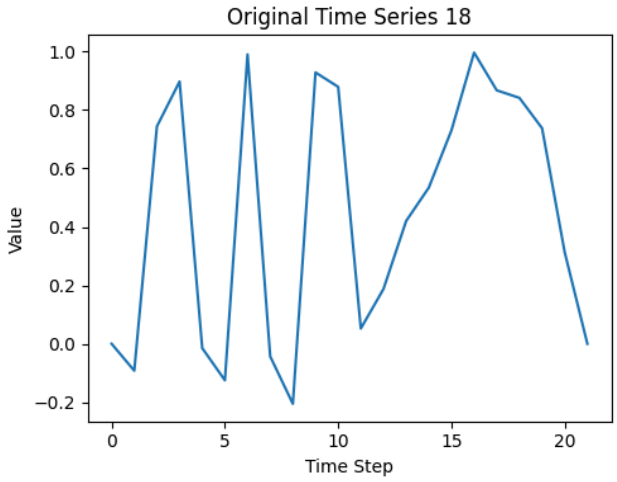
Time Step


Warped Time Series 17
Value
Time Step


Original Time Series 18
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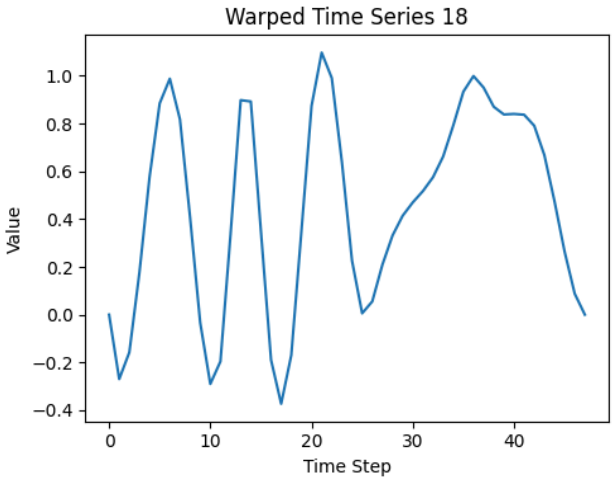
Time Step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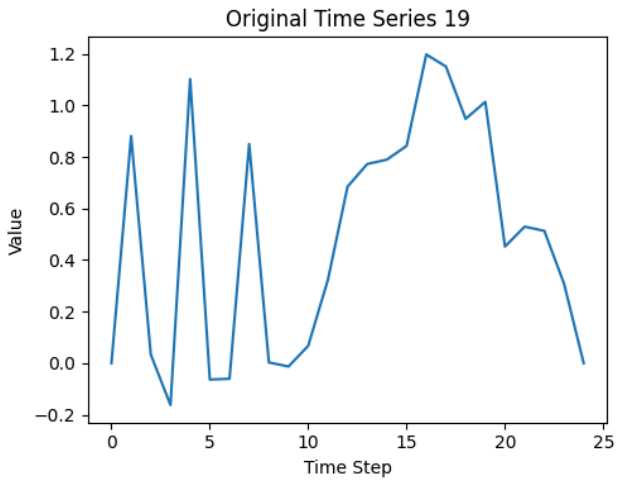
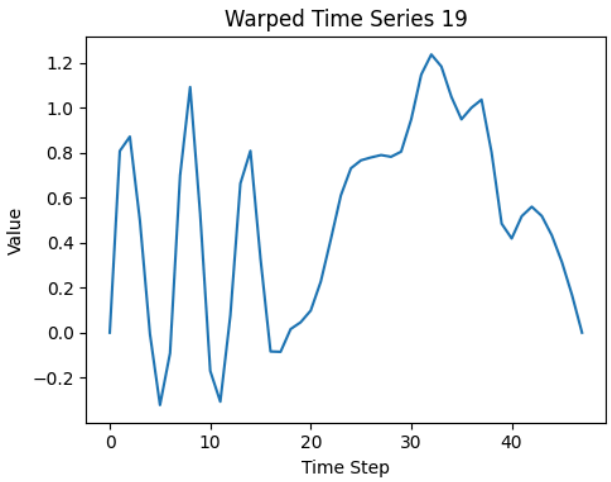
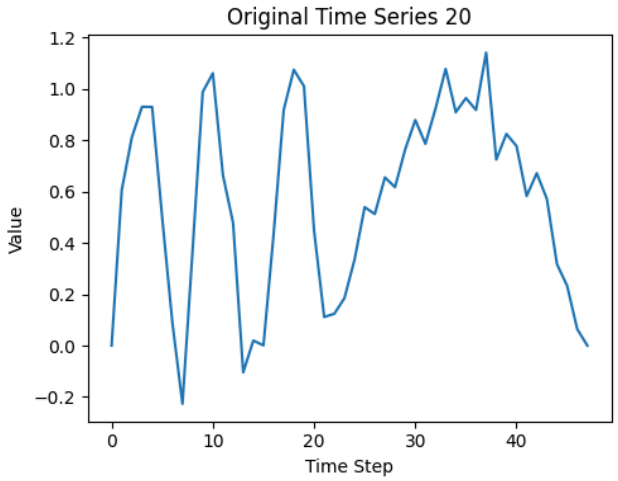
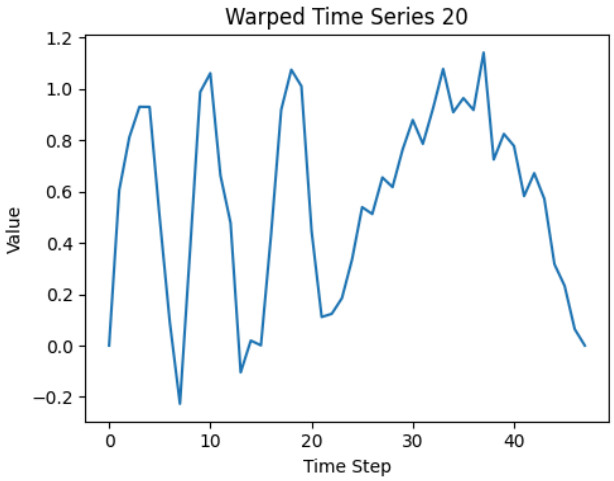
Time Step


Original Time Series 19
Value
Time Step


Warped Time Series 19
Value
Time Step


Original Time Series 20
Value
Time Step


Warped Time Series 20
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Time Step